FAIRBANKS COMMAND AND DATA ACQUISITION STATION (FCDAS), 9-& 12-METER ANTENNA
(National Oceanic and Atmospheric Administration (NOAA))
(National Environmental Satellite, Data, and Information Service (NESDIS))
East and west of Eisle Road's intersection with Steese Highway
Fairbanks
Fairbanks North Star Borough
Alaska

HAER AK-51
AK-51

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
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HISTORIC AMERICAN ENGINEERING RECORD

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National Oceanic and Atmospheric Administration (NOAA)
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Location: Township 2 North, Ranges 1 and 2 East, Fairbanks Meridian

The FCDAS is generally located east and west of Eisle Road's intersection with Steese Highway, approximately 13.5 miles northeast of Fairbanks, Alaska. The 9-meter antenna and 12-meter antenna are located on an 8,500-acrea Federal reservation in the west end of the Gilmore Creek valley. The extent of the FCDAS is approximately defined by the ridgeline of surrounding hills, which help protect the low-level signals received by the station from radio interference.

The 9-meter antenna is located on the Bruce Domorski Road near a switchback leading up to Antenna Ridge Road. The 12 meter antenna is located directly north of Eisele Road on a pad between the Facilities Building and the Operations Building.

Year of Construction: The 9-meter antenna was constructed in 1965. The 12-meter antenna was constructed in 1966.

Manufacturer: Philco Corporation
WDL Division
Palo Alto, CA

Present Owner: NOAA

Present Use: Out of Service

Significance

The 9-meter antenna and 12-meter antenna lies within the overall FCDAS complex and was part of the equipment array associated with the historical development of the Nation's initial weather satellite programs in the 1960s. The 9-meter antenna and 12-meter antenna have been determined eligible to the National Register of Historic Places using *Guidelines for Evaluating and Nominating Properties that Have Achieved Significance Within the Past Fifty Years* (National Register Bulletin 22). The antenna's significance relates to both the large-scale weather data collection and the earlier geophysical satellite programs developed under fledgling National Aeronautics and Space Agency (NASA) activities at the dawn of the Space Age.

Physical Description

9-Meter Antenna:

In concept, the 9-meter antenna is a simple structure comprised of a supporting base or "pedestal" that carries the weight of the rotational mechanisms, an X-Y axis assembly, and a dish reflector and feed unit. With the dish in a horizontal position, the overall antenna assembly stands 50 feet above the ground. The antenna originally was designed in English measurement units (as a 30-foot dish) and the following discussion presents information in the original dimensioning.

The pedestal is supported on four rectangular concrete footings that measure 60 by 42 by 15 inches, which in plan form a diamond shape foundation. A "birdcage" assembly consisting of 6-inch tubular steel pipe and W10 I-beams create the main structure of the pedestal. The lower assembly consists of two vertical pipes, one each at the north and south footings, with a pair of angled tubes at each of the other footings. These support a diagonally braced frame comprised of 9-inch tubular steel horizontal members that form a 5'6" by 11'6" horizontal frame. The frame also supports two access ladders on the east and west sides that permit servicing of the rotating assemblies. Two tripod assemblies, also comprised of 6-inch tubular steel pipe, form the supports for the 9-inch X-axis shaft. These raise the overall assembly another 10'6" for an overall height above ground of 20 feet. A diamond shaped equipment cabinet, 11 feet on each side, lies inside the lower support unit.

The X-axis "wheel: is a fabricated steel unit, which has an 8'6" raduys and is 5'2" thick. The other edge provides the drive plate gearing. Two 6- by 10-foot triangular steel columns extend from the drive assembly to form the Y-axis mounts. These upper bearing mounts are spaced 13'3" apart.

The Y-axis unit has a circular cross section with a 12-foot diameter. Te unit is comprised of a central circular band, which is 39 inches wide, with tapered conical sections above and below the band. The overall "vertical" dimension of this unit is 13 feet. A 9-inch shaft runs through the center of the unit. Both rotational units are powered by hydraulic motors.

The angled steel truss system of the reflector dish attaches directly to the upper section of the Y-axis unit. The reflector is formed by 12 trapezoidal panels (in plan) that also form the parabolic shape on the upper chord of the truss. The outer chord of each panel is 8 feet and overall length is 12 feet. A center area that supports the instrumentation package is 4 feet in diameter, giving the overall unit a 30-foot diameter. The upper surface of the panels is sheathed in a reflective metal surfacing. Unlike the antenna at the station, which uses a feedhorn collector system, the 9-meter antenna uses a cassegrain feed system. Incoming signals are focused on a feed reflector mounted on a quadripod assembly above the main dish unit. The feed reflector then transmits signals to the main cassegrain collector mounted at the center of the reflector dish. The quadripod assembly consists of four 9-inch-diameter steel tubes that converge at the focal apex

12 feet above the center of the dish. Each leg measures 16 feet long and is mounted on the face of the primary disk at a distance of 21'6" from each other.

The main cassegrain collector lies at the vertex of the parabolic dish. It consists of a tapered tube measuring 36 inches at its base and 14 inches at the top. Overall height is 4'10".

12-Meter Antenna:

In concept, the 12-meter antenna is a simple structure comprised of a base or "lower tower" that supports the main antenna elements, a pedestal or "upper tower" that provides the rotational tracking capabilities, and an antenna dish to collect signals transmitted from satellites. The antenna originally was designed in English units (as a 40-foot dish) and the following discussion presents information in original dimensioning.

The base is constructed from W24 x 162 steel I-beams for legs with additional internal cross-braces of similar size. The upper 3'8" portion consists of a fabricated plate steel "box" with gusseted stiffeners. The base forms a trapezoidal structural complex sheathed in 18-guage insulated sheet panels that form an enclosed base. A double-door system, consisting of 2'6" by 7'0" individual units, provides access to the base enclosure and some of the mechanical systems. Base connections are supported by 45- by 45-inch concrete foundation piers. Dimensions are 22 by 24.5 feet at the base tapering to 24 by 10 feet at an elevation of 12 feet.

The pedestal consists of an X-Y type of movement that supports the dish assembly. The assembly consists of a central yoke supported by two vertical upper tower brackets. The brackets extend 10 feet above the base and have a nominal cross section of 5'10" by 3'0". The brackets hold the shaft of the central gimbal assembly, which allows movement about the X-axis, while the compound gimbal assembly permits movement in the Y-axis direction. Distance between brackets is 20 feet to inside rotational faces, with the brackets nominally 4'0" by 7'9" in section. A hydraulic motor drives a 12-foot-diameter steel plate gear mounted on the gimbal shaft.

The Y-axis unit also consists of a 12-foot-diameter flat drive plate attached to a steel housing that rotates around a 1-foot-diameter shaft. The housing supports two bent-bracket arms that connect the reflector assembly to the gimbal assembly. The arms or "columns" suspend the dish assembly 10'4" above the gimbal unit.

The reflector is comprised of a concave truss system of radiating steel angle-iron fabricated wedge-shaped units, each measuring 18'6" long with an outer lip dimension of 62 inches and an inner dimension of 9 inches at the central hub. The panels have a compound curve that creates the overall parabolic shape of the reflector. The dish is formed by 24 linked panels, which are surfaced with a reflective metal skin. With the 1.5-foot central core, the structure forms a 40-foot (nominally 12-meter) dish.

The key element for reception is the feedhorn system, which is suspended above the dish by four tapered truss supports that attach to the surface of the reflector. These are spaced 20 feet apart at the reflector and 7 feet apart at the feedhorn, with a nominal angle of 70 degrees. The feedhorn centers 19 feet above the center of the dish and forms a rectangular box 3'8" wide by 8'4" long. A central feed support runs from the feedhorn to the center of the dish and is cabled into the electronic feed system in the base. The feedhorn provides the collection point for signals radiated by the dish assembly, much in the way that a telescope concentrates light to an optical collection unit.

When the dish is in horizontal position, the top of the feedhorn lies 60 degrees above the ground.

History

In the mid-1950s, the United States under the Eisenhower Administration announced plans for the development of an unmanned Earth satellite to be launched into orbit in conjunction with the International Geophysical Year (July 1, 1957, to December 31, 1958). The goal of the initial satellite program, Project Vanguard, was to put an object into orbit around the earth, collect data, and to conduct scientific experiments on the earth's atmosphere. The Russian government had the same goal and successfully launched Sputnik 1, the first man-made satellite, into space on October 4, 1957. The first successful United States satellite launch occurred with Explorer 1 on January 31, 1958. NASA was officially established in October 1958. With these events, the age of satellite telemetry and space exploration had begun.

In 1961, Congress provided funding for an operational meteorological system to be administered and run by the US Weather Bureau, Department of Commerce. The Television Infrared Observation Satellite (TIROS) and Nimbus Programs were born from this initiative.

NASA identified Gilmore Valley near Fairbanks, Alaska, as an ideal location for a satellite data collection facility. The deep and remote valley provided a radio-quiet environment to receive low-level satellite transmissions. By 1961, NASA had set up its first Data Analysis Facility on the site with an operations building and one active 85-foot (26-meter) antenna. The facility was operated by the Geophysical Institute at the University of Alaska, Fairbanks, under contract to NASA. The facility's initial mission was to receive data transmitted by the first polar-orbiting satellites.

By 1964, a worldwide network of satellite tracking stations was established by NASA, referred to as the Satellite Tracking and Data Acquisition Network (STADAN). The operations building and first two antennas served as components of the former Alaska STADAN station, which supported early weather satellite programs. In 1965, a 40-foot (12-meter) parabolic dish antenna was added to download data from satellites when the 85-foot (26-meter) antenna was unavailable.

Minitrack was one of the first satellite programs implemented by the newly formed NASA, with a mission to accurately determine the earth's orbit, thereby yielding completely new information about the earth's gravity field and shape. In 1966, the Alaska Minitrack system located at the "College Site" 6 miles north of Fairbanks was relocated to the Gilmore Creek facility. Minitrack system data were received by an array located in open space surrounding the Facilities Building. Seven Minitrack system stations, including the Gilmore Creek Tracking Station, were

established in North and South America between 1958 and 1967. The Alaska Minitrack array was relocated when the University moved its operations to Poker Flats, Chatanika, Alaska. In the late 1960s, the Minitrack system was replaced by more sophisticated programs.
The first large-scale weather satellite program was the TIROS Program, with TIROS-1 launched in 1960. TIROS satellites proved extremely successful, providing the first accurate weather forecasts based on data gathered from space. TIROS began continuous coverage of the earth's weather in 1962 and was used by meteorologists worldwide. The program's success with many instrument types and orbital configurations lead to the development of more sophisticated meteorological observation satellites. TIROS was the first Polar Orbiting Environmental Satellite (POES) employed. The TIROS Program launched 11 satellites between 1960 and 1978, with the last TIROS satellite decommissioned in 1981.

The next large weather satellite program NASA launched was Nimbus. Given the success of the TIROS program, the primary objective of the Nimbus program was to develop a satellite system capable of meeting the needs of the world's atmospheric science research community. The Nimbus system was originally designed as a replacement for TIROS and became the means to test new remote sensing techniques as well as a means to sense the radiative properties of the earth's land masses, oceans, and the atmosphere. Other goals of the program included the development of new earth surface mapping techniques, new ground data processing techniques, and the capability to sense atmospheric variables in the surroundings. NASA built and launched the satellite known as the Nimbus Operational Satellite (Nimbus 1) on August 28, 1964. There were two tracking stations for Nimbus, one in Alaska, and the other in eastern Canada. The first equipment implemented to support this program was a 26-meter antenna constructed by Rohr at Gilmore Creek in 1962. The Nimbus Program launched seven satellites between 1964 and 1978, with the last Nimbus satellite decommissioned in 1994.

The Gilmore Creek facility supported TIROS and Nimbus Programs throughout their lifetimes. More recently, FCDAS has supported the POES Program, a cooperative effort between NASA and the NOAA, the United Kingdom, and France. The POES mission is composed of two polar orbiting satellites. These satellites primarily provide long-range weather forecasting. POES satellites circle the earth every 12 hours traveling from pole-to-pole.

FCDAS also supports the Geostationary Operational Environmental Satellite (GOES) Program with satellites that orbit the earth in a geosynchronous manner along an equatorial plane, meaning that it is able to monitor the same location all the time. The GOES program was initiated in 1975 and is active to the present.

The Goddard Range and Range Rate (GRARR) II tracking system was constructed at the Gilmore Creek facility by NASA in 1965. The GRARR II system consists of a building and an antenna with a diameter of 9-meters (30 feet). It was one of several systems in the GRARR network used to track the locations of satellites. Over its life, the antenna collected positional data for the TIROS and Nimbus satellites, as well as the subsequent PES and GOES satellites.

The 9-meter antenna sent a signal to the spacecraft, which replied through a transponder. By recording the time of the signal transit to and from the satellite, its distance could be determined. Radio signals received by the antenna were also correlated with the receipt of radio signals by other distant antennas to allow triangulation of the satellites' positions in space. Thus, it was capable of determining both the range (position) and the rate of range change (relative velocity) of the spacecraft. The FCDAS GRARR II tracking system is now referred to as the Range and Range Rate.

The 9-meter antenna was operational from 1965 to 1982, at which time it was inactivated. Operational equipment was removed from the antenna in 1984, making it inoperable. NOAA assumed control of the station in 1984, at which time it became the FCDAS. The antenna has not been used since 1984.

Project Statement

The historical report was edited by HAER Collections Manager Sara Artes in 2009 to more closely comply with Secretary of Interior Standards for HAER.